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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/007,630	11/09/2001	Ming Cai	06618-736001/CIT-3345	9976
20985	7590	11/21/2003	EXAMINER	
FISH & RICHARDSON, PC 12390 EL CAMINO REAL SAN DIEGO, CA 92130-2081			CALEY, MICHAEL H	
			ART UNIT	PAPER NUMBER

2871

DATE MAILED: 11/21/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/007,630

Applicant(s)

CAI ET AL.

Examiner

Michael H. Caley

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 and 24-32 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-12 is/are allowed.
- 6) ☒ Claim(s) 13-20 and 24-32 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____.
- ☐ Interview Summary (PTO-413) Paper No(s) ____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 13, 14, 24, and 25 are rejected under 35 U.S.C. 102(b) as being anticipated by Knight et al. (“Phase-matched excitation of whispering-gallery-mode resonances by a fiber taper”, Optics Letters, vol. 22, pp. 1129-1131, 1997).

Regarding claim 13, Knight discloses:

an optical fiber coupler having a tapered fiber section (Figure 2A) formed of a fiber cladding material to form an optical waveguide based on interfacing between the fiber cladding material and air (Page 1129), a first single-mode fiber (Page 1129, abstract) for light at a first wavelength connected to a first side of said tapered fiber section (Figure 2A), and a second single mode fiber for light at a second wavelength connected to a second side of the tapered fiber section (Figure 2A),

wherein said tapered fiber section has a structure to support at least one waveguide mode at said first wavelength and one waveguide mode at said second wavelength (Page 1129),

wherein first and second wavelengths may or may not be the same.

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Regarding claim 14, Knight discloses the first and second single-mode fibers as connected to the tapered fiber section under an optical adiabatic transformation (Page 1129).

Regarding claim 24, Knight discloses a coupler having:

a tapered waveguide section to guide optical energy in at least one mode at a first wavelength and one mode at a second wavelength and to expose an evanescent field of said guided optical energy outside the tapered waveguide section (Page 1129);

a first waveguide section to guide optical energy in at least one mode at a first wavelength connected to a first side of the tapered waveguide section to allow for conversion of optical energy between the one mode at the first wavelength in the tapered waveguide section and the first single mode (Page 1129); and

a second waveguide section supporting a second single mode at the second wavelength connected to a second side of the tapered waveguide section to allow for conversion of the optical energy between the one mode at the second wavelength in the tapered waveguide section and the second single mode (Page 1129).

Regarding claim 25, Knight discloses the waveguide section as formed of a fiber (Page 1129).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 13-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cai ("Fiber-coupled microsphere laser" Optics Letters; October 1, 2000) in view of Knight.

Regarding claim 13, Cai discloses an optical fiber coupler having:

a first fiber for light at a first wavelength connected to a first side of said tapered fiber section, and a second fiber for light at a second wavelength connected to a second side of the tapered fiber section (Figure 1A),

wherein said tapered fiber section has a structure to support at least one waveguide mode at said first wavelength and one waveguide mode at said second wavelength (Page 1430).

Cai fails to disclose the optical fiber coupler as having the tapered fiber section formed of a fiber cladding material to form an optical waveguide based on interfacing between the fiber cladding material and air. Knight, however, teaches a highly efficient coupling technique between a single mode fiber taper and a sphere resonator in which single mode fiber is tapered to form a waveguide based on interfacing between the silica cladding portion and air.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Cai's tapered coupling fiber as taught by Knight. By forming a waveguide based on interfacing between the fiber cladding material and air, a maximum amount of the optical energy may be coupled to the optical element, as taught by Knight. Increasing the

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amount of light coupled to the optical element would have been motivated by a desire to maximize the coupling efficiency from the pump input to the laser output. Such a design would have been advantageous to conserve power in operating the laser.

Regarding claim 14, Cai fails to disclose the first and second fibers as connected to the tapered fiber section under an optical adiabatic transformation. Knight, however, teaches the fiber taper as performed in an adiabatic transformation in order to couple light most efficiently (Page 1129).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have created an adiabatic transformation between the fibers and tapered fiber sections. Such a design consideration would have been motivated by a desire to minimize loss through the taper, effectively increasing the coupling efficiency from the light source to the optical element. Creating an adiabatic transformation would have been advantageous to conserve power in operating the laser.

Regarding claim 15, Cai discloses a micro cavity that supports at least one whispering gallery mode at the first wavelength and second wavelength, absorbing light at the first wavelength to produce light at the second wavelength, the micro cavity located relative to the tapered fiber section to evanescently receive light at the first wavelength from the tapered fiber section and to evanescently couple the light at the second wavelength into the tapered fiber section.

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Regarding claim 16, Cai discloses the micro cavity as in direct contact with a respective tapered fiber section (Page 1431).

Regarding claim 17, Cai discloses the micro cavity as spaced apart from the tapered fiber portion (Page 1431)

Regarding claim 18, Cai discloses the micro cavity as a dielectric material doped with rare-earth ions (Page 1430, abstract).

Regarding claim 19, Cai discloses the micro cavity as a sphere (Page 1430).

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cai in view of Knight and in further view of Stone et al. (U.S. Patent No. 5,742,633 "Stone").

Cai and Knight fail to disclose the micro cavity as having a shape other than that of a sphere. Stone, however, teaches asymmetrical optical cavities having various shapes other than that of a sphere (Figures 3A and 3B).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a micro cavity such as taught by Stone. One would have been motivated to use such a cavity as a means of achieving a higher input-output coupling efficiency (Column 2 lines 32-35).

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Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Knight in view of Ho (U.S. Patent No. 5,926,496).

Knight fails to disclose the waveguide sections as formed of a planar waveguide on a substrate. Ho, however, teaches a microcavity resonator device formed of a planar waveguide on a substrate.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have formed the waveguide sections of the coupler disclosed by Knight from a planar waveguide on a substrate. As taught by Ho, such resonators have applications as switches, intensity modulators, filters, and WDM multiplexors (Column 2 lines 43-47). One of ordinary skill in the art would have been motivated to construct Knight's device of a planar waveguide on a substrate in order to benefit from advantages as are old and well known in the art. Such advantages include precision in forming the waveguide using advanced etching techniques and incorporating such devices in an integrated optical circuit in a confined space. Forming the waveguide on a planar substrate would allow for the device to be constructed precisely in a confined space and to benefit from a maximum coupling efficiency due to the high precision construction.

Claims 27-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Knight in view of Cai.

Regarding claims 27, 30, and 31, Knight discloses an optical element located to evanescently couple light at the first wavelength from the tapered section. Knight fails to disclose the optical element as located to evanescently couple light at the second wavelength into

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the tapered fiber section. Cai, however, teaches an optical element located to evanescently couple the light at the first wavelength from the tapered waveguide and to evanescently couple light at the second wavelength into the tapered fiber section in a microsphere laser application (Page 1430).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized the high efficiency coupling between a microsphere and a fiber in realizing a fiber-coupled microsphere laser as taught by Cai. One would have been motivated to locate the microsphere as taught by Cai in order to evanescently couple a laser wavelength from the optical device to the fiber. Such a modification would have been advantageous to allow for the realization of an efficiently coupled laser using the apparatus as disclosed by Knight and the teachings from Cai.

Regarding claim 28, Knight discloses the optical element as including an optical cavity (Page 1129).

Regarding claims 29 and 32, Knight discloses the optical cavity as a whispering-gallery-mode cavity.

Response to Arguments

Regarding the rejection of claims 13, 14, 24, and 25 under 35 USC 102(b) by Knight, the claims fail to limit the first and second wavelengths and first and second modes to being distinct. As worded, the first and second wavelengths and modes may be the same or different. Also, the optical fiber portions on either side of the taper disclosed by Knight may be viewed as either a single optical fiber or as two distinct optical fibers.

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Allowable Subject Matter

Claims 1-12 are allowed.

The following is a statement of reasons for the indication of allowable subject matter:

The prior art fails to disclose an optical fiber portion having the biconically tapered section in which the diameter gradually reduces and increases as proposed in which one untapered single mode fiber section has a diameter larger than the other untapered single mode fiber section.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael H. Caley whose telephone number is (703) 305-7913. The examiner can normally be reached on M-F 8:30 a.m. - 5:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Kim can be reached on (703) 305-3492. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



mhc



ROBERT N. KIM
SUPERVISOR
TECHNOLOGY CENTER 2800